Knight Ch 2 *

Conc Q 5

velocity = slope of position vs time.

a) slope for A is larger ⇒ A has larger speed

b) yes - slopes are approx same at $t = 3s$

⇒ speeds are same at $t = 3s$.

Knight Ch 2

4ed Conc Q 7

velocity = slope x vs t.

speed = magnitude velocity.

a) steepest slope at C ⇒ fastest at C

b) left when x decreases or slope negative ⇒ left at F.

c) speeding up ⇒ slope increases ⇒ speeding up at B

d) turning around ⇒ x starts to decrease ⇒ turning around at E

Knight Ch 2

Conc. Q 8

a) Yes, the dots coincide at t = 3 and t = 6 as labeled below

b) They need to travel the same distance in a time interval. A travels the same distance in every interval. B only travels this distance between 4 and 5 ← YES

Knight Ch 2

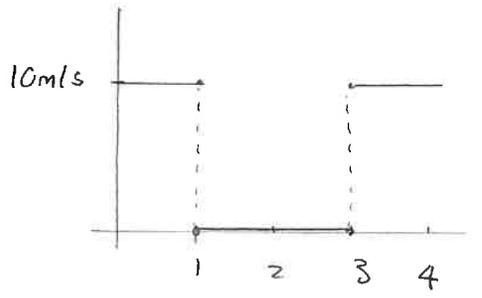
4ed Prob 5

Velocity = slope of x vs t

a) from 0-1s slope = $\frac{\Delta x}{\Delta t} = \frac{10m}{1s} = 10\,m/s$

from 1s-3s slope = 0 m/s

from 3s-4s slope = $\frac{10m}{1s} = 10m/s$



b) No it stops from 1-3s but resumes moving right after

Knight Ch 2

Problem 6

a) Yes when $v = 0$. This occurs at $t = 1s$.

b) $X_f = X_i +$ area under curve from t_i to t_f

let $t_i = 0s$

$X_f = 10m +$ area under curve from $0s$ to t_f.

For $t_f = 2s$ area $= 0m \Rightarrow X_f = 10m$

$t_f = 3s$ area $= 1\frac{1}{2}$ blocks $= 1.5 \times \underbrace{4m}_{\text{area of one block}}$

$= 6m$

$\Rightarrow X_f = 16m$

$t_f = 4s$ area $= 4$ blocks $= 4 \times 4m = 16m$.

$\Rightarrow X_f = 26m$.

t	x
2	10m
3	16m
4	26m

Knight Ch2

4ed Prob 8

The key concept is

Δx = area under graph over time interval

Since the object starts at $x=0$ at $t=0$, the area under graph from 0s to any time t will give position at time t.

We then use this to calculate positions at 2s, 4s, 6s.....

Now each block on the graph has area $5\,m/s \times 2s = 10m$.

time	number blocks	area	Δx	x at end of time period.
0 → 2s	1/2	5.0m	5.0m	5.0m
0 → 4s	2	20m	20m	20m
0 → 6s	3.5	35m	35m	35m ←
0 → 8s	4	40m	40m	40m
0 → 10s	4 − 0.5 = 3.5	35m	35m	35m ←

We see that at the object is at 35m after 6s and 10s

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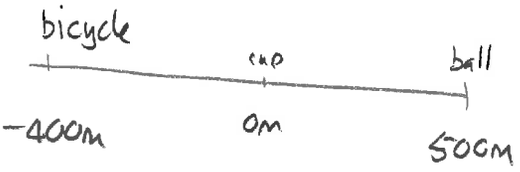
Man $t_1 = 0s$ $x_1 = 0m$

$t_2 = 200s$ $x_2 = 500m$



$$V_{av} = \frac{x_2 - x_1}{t_2 - t_1} = \frac{500m - 0m}{200s - 0s} = 2.5m/s$$

Dog $t_1 = 0s$ $x_1 = 0m$

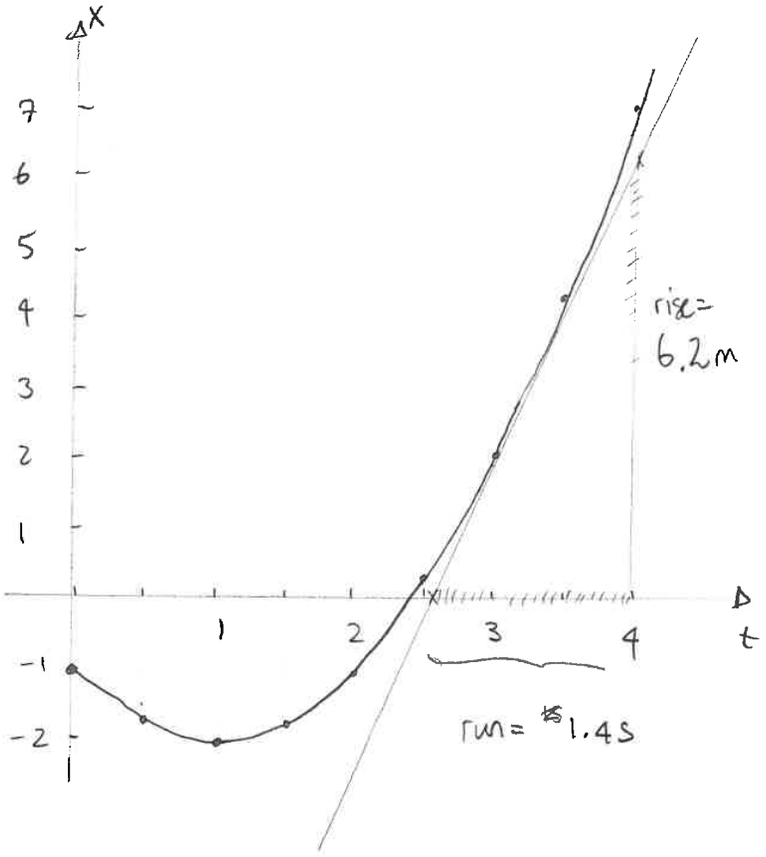
Instant 2 reaches ball $t_2 = 50s + 150s = 200s$ $x_2 = 500m$

$$V_{av} = \frac{x_2 - x_1}{t_2 - t_1} = \frac{500m - 0m}{200s} = 2.5m/s$$

SAME

a)

t in s	x in m
0	−1
0.5	−1.75
1	−2
1.5	−1.75
2	−1
2.5	0.25
3	2
3.5	4.25
4	7



b) $\text{slope} = \frac{\text{rise}}{\text{run}} = \frac{6.2\text{m}}{1.4\text{s}} = 4.4\text{m/s}$

c) at $t_i = 3.0\text{s}$ $x_i = 2\text{m}$

$t_f = 3.1\text{s}$ $x_f = 2.41\text{m}$

$\Rightarrow v_{avg} = \frac{\Delta x}{\Delta t} = \frac{2.41\text{m} - 2\text{m}}{0.1\text{ s}} = 4.1\text{m/s}$

d) $t_f = 3.01\text{s}$ $x_f = 2.0401\text{m}$ $\Rightarrow v_{avg} = \frac{\Delta x}{\Delta t} = \frac{2.0401\text{m} - 2\text{m}}{0.01\text{s}} = 4.01\text{m/s}$

e) deriv of x = deriv of t^2 − deriv of $2t$ − deriv of $1 = t^0$

$2t^1$ $\quad 2 \cdot 1 t^{1-1}$ $\quad$ ~~$0t^{-1}$~~

$\Rightarrow v = 2t - 2$

at 3.0s $\quad v = 2 \times 3.0\text{s} - 2 = 4.0\text{m/s}$

g) $V = 0 = 0$ $\quad 0 = 2t - 2 = 0$ $\quad t = 1.0\,s$